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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/821,648	03/29/2001	Zheng J. Geng	40169-0031	5727

20480 7590 08/11/2008

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ART UNIT	**PAPER NUMBER**
2621	

MAIL DATE	DELIVERY MODE
08/11/2008	PAPER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ZHENG J. GENG

Appeal 2008-1153
Application 09/821,648[1]
Technology Center 2600

Decided: August 11, 2008

Before MAHSHID D. SAADAT, ROBERT E. NAPPI, and
SCOTT R. BOALICK, *Administrative Patent Judges*.

BOALICK, *Administrative Patent Judge*.

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[1] Application filed March 29, 2001. Application 09/821,648 is a continuation-in-part of 09/098,322 filed June 16, 1998. The real party in interest is Genex Technologies, Inc.

DECISION ON APPEAL

This is an appeal under 35 U.S.C. § 134(a) from the final rejection of claims 1-14 and 16-44, all the claims pending in the application. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

STATEMENT OF THE CASE

Appellant's invention relates to omnidirectional imaging. In the words of the Appellant:

> the present invention is directed to an efficient omnidirectional image processing method and system that can obtain, in real-time, non-distorted perspective and panoramic images and videos based on the real-time omnidirectional images acquired by omnidirectional image sensors. Instead of solving complex high-order nonlinear equations via computation, the invention uses a mapping matrix to define a relationship between pixels in a user-defined perspective or panoramic viewing window and pixel locations on the original omnidirectional image source so that the computation of the non-distorted images can be performed in real-time at a video rate (e.g., 30 frames per second).

(Spec. paragraph [0007].)

Claims 1 and 14 are exemplary:

> 1. A method for generating a selectable perspective view of a portion of a hemispherical image scene, comprising the steps of:
>
> acquiring an omnidirectional image on an image plane using a reflective mirror that satisfies a single viewpoint constraint and an image sensor;

defining a perspective viewing window based on configuration parameters; and

mapping each pixel in the perspective window with a corresponding pixel value in the omnidirectional image on the image plane using a look-up table based on the configuration parameters.

14. An improved imaging apparatus for generating a two-dimensional image, comprising:

a reflective mirror configured to satisfy an optical single viewpoint constraint for reflecting an image scene;

an image sensor responsive to said reflective mirror and that generates two dimensional image data signals to obtain an omnidirectional image on an image plane; and

a controller coupled to the image sensor, wherein the controller defines a perspective viewing window based on configuration parameters and maps pixels from said omnidirectional image into said perspective viewing window; and

a memory for storing a mapping matrix for each of a plurality of sets of said configuration parameters in a parameter space, said controller using a said mapping matrix to perform mapping of pixels from said omnidirectional image into said perspective viewing window.

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Mick	US 3,988,533	Oct. 26, 1976
Gabriel	US 4,908,874	Mar. 13, 1990
Baker	US 5,686,957	Nov. 11, 1997

Chahl	US 5,790,181	Aug. 4, 1998 (§ 102(e) date May 1, 1996)
Glatt	US 5,870,135	Feb. 9, 1999 (filed Jul. 15, 1997)
Nayar	US 6,118,474	Sep. 12, 2000 (filed Dec. 5, 1997)
Korein	US 6,226,035 B1	May 1, 2001 (filed Mar. 4, 1998)

Claims 1-6 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar and Glatt.

Claims 7-9 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar, Glatt, Chahl, and Mick.

Claims 10-13 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar, Glatt, and Baker.

Claims 14 and 16-23 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar and Gabriel.

Claims 24 and 25 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar, Gabriel, Chahl, and Mick.

Claims 26-29 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar, Gabriel, and Baker.

Claims 30-38 and 44 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar, Gabriel, and Korein.

Claims 39 and 40 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar, Gabriel, Korein, Chahl, and Mick.

Claims 41-43 stand rejected under 35 U.S.C. § 103(a) as being obvious over Nayar, Gabriel, Korein, and Baker.

Rather than repeat the arguments of Appellant or the Examiner, we make reference to the Briefs and the Answer for their respective details. Only those arguments actually made by Appellant have been considered in this decision. Arguments that Appellant did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).[2]

ISSUE

The issue is whether Appellant has shown that the Examiner erred in rejecting the claims under 35 U.S.C. § 103(a).

FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence.

1. Nayar is directed to an omnidirectional imaging apparatus 100 that senses an image of a scene from a single viewpoint using a substantially paraboloid-shaped reflector 135 and an image sensor 110. (Abstract; col. 1, ll. 19-22; col. 3, ll. 11-17; col. 7, ll. 29-38; col. 8, ll. 30-40; Fig. 1A) Nayar also explains that hyperboloidal-shaped reflectors have been used in the prior art. (Col. 2, ll. 40-50, col. 2, l. 67 to col. 3, l. 1.)

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[2] Except as will be noted in this opinion, Appellant has not presented any substantive arguments directed separately to the patentability of the dependent claims or related claims in each group. In the absence of a separate argument with respect to those claims, they stand or fall with the representative independent claim. *See* 37 C.F.R. § 41.37(c)(1)(vii).

2. The system of Nayar "enables viewing of any portion of the scene, enables zooming in on a selected portion, and enables panning of the scene, all with respect to the single viewpoint and without requiring image reconstruction of complex frame transformation." (Col. 9, ll. 56-62.) Nayar teaches that a video signal representative of the image is sent to a general purpose computer 125, which "is programmed to allow the user to view any desired portion of the hemispherical scene, to zoom in on a selected portion of the scene, or to pan the scene in any desired manner." (Col. 7, ll. 52-66; see also col. 10, ll. 57-64; Fig. 1A.)

3. Referring to Fig. 5, Nayar teaches that "there is a one-to-one correspondence between the x-y coordinate of the point of intersection with the reflector 135 of the orthographically projected ray, and the x-y coordinate of the point at which that orthographically projected ray intersects the planar light-sensitive surface of the image sensor 110" (col. 10, ll. 14-19) and that "mapping of the image into a Cartesian-coordinate system is a simple task for persons skilled in the art" (col. 10, ll. 29-30). Nayar teaches that cylindrical-coordinate mapping may be performed in addition to Cartesian-coordinate mapping. (Col. 11, ll. 26-55.)

4. Referring to Fig. 6 in light of the one-to-one correspondence taught by Fig. 5, Nayar teaches "a technique for zooming in on any selected portion of the substantially hemispherical scene." (Col. 10, ll. 31-33.) "In order to zoom in at a focal distance f on a selected portion of the

scene centered around a point 550, with a specified size, only the image signals of the CCD cells located with the same range of x-y coordinates as the region of the reflecting surface projecting the selected portion of the scene are selected for magnification and viewing." (Col. 10, ll. 35-41; see also col. 10, ll. 42-53; Fig. 6.) "As a result of the orthographic reflection and the one-to-one correspondence described above, no image reconstruction or complex frame transformation is required." (Col. 10, ll. 53-56.) Nayar also teaches that "[a] general purpose computer 125 can be readily programmed by one skilled in the art to perform the above steps to enable viewing of any portion of the hemispherical scene from a single viewpoint, and to also enable zooming in on any particular portion to provide an enlarged image of that portion. Furthermore, by designating successive points along the reflector, the hemispherical scene can be panned as if one were viewing the scene from a single viewpoint." (Col. 10, ll. 57-64.)

5. Nayar teaches a program, attached as Appendix I, to "map the sensed omnidirectional image to an ordinary perspective image that is suitable for display on computer 125." (Col. 11, ll. 7-9.) "The program requires the user to input the name, center location, and radius of the omnidirectional image to be converted. . . . [and] also requires the user to input a name for the generated perspective image, as well as a focal length and size for the perspective image." (Col. 11, ll. 9-14.)

6. Fig. 10 of Nayar teaches "a method for sensing an image of a substantially hemispherical or spherical scene from a single viewpoint." (Col. 12, ll. 16-18.) The method includes the steps of "mapping the image data into an appropriate coordinate system 1040," "specifying a viewing direction, a focal length, and an image size 1045," "zooming in 1050 on a selected portion of the image data," and "forming a digital image 1070 from the mapped image data." (Col. 12, ll. 20-34.)

7. Glatt describes an image forming and processing device 10 that uses a fisheye lens 20 and has a substantially hemispherical field of view. (Abstract; col. 1, ll. 12-15; Fig. 1.) "The invention allows an operator to view a selected part of the image formed by the fisheye lens as if it were formed by a normal lens by simulating the panning, tilting or zooming of the normal lens. . . . without the use of moving parts." (Col. 1, ll. 15-21; *see also* col. 5, ll. 13-31, 52-65.) Glatt uses a look-up table 222, and teaches that:

> As pointing device 214 is moved to simulate panning and/or tilting of the hypothetical camera, the rectangular coordinates (X;Y) of each pixel in each line of pixels in sub-area a are generated by area select unit 210 and stored in look-up table ("LUT") 222. The system also automatically calculates the coordinates (X_d ;Y_d) of the fisheye image . . . . For each set of normal coordinates (X;Y) in sub-area a, the calculated coordinates (X_d ;Y_d) are stored in LUT 222 as addresses in [dual-ported image memory] DPIM 200.
>
> All of the coordinates for the fisheye image could be pre-calculated or only the coordinates for a particular area need be calculated as the area is selected. In either

> case, the coordinates are stored in LUT 222 and the corresponding pixels are stored in DPIM 200. This allows the pixels corresponding to those calculated coordinates to be fetched from CCD 180. The fetched pixels are then displayed on monitor 240 at locations (X;Y) just as if the image had been formed by the panning and tilting of a normal camera to coordinates (X;Y).

(Col. 8, ll. 25-43; Fig. 5.)

8. Gabriel describes a system for spatially transforming images. (Abstract; col. 1, ll. 23-26; col. 2, ll. 5-9; col. 4, ll. 19-24.) "The concept however is quite general and includes any odd warping of an image such as that produced by a fish-eye lens or a fun house mirror." (Col. 4, ll. 24-26.) Gabriel teaches the use of matrices to perform the transformations. (Col. 4, l. 28-67; col. 6, l. 16 to col. 8, l. 54.) Gabriel also teaches that "[t]ranslation, scaling, rotation and shearing are all special cases of affine transformation. These four taken together can produce all possible affine mappings." (Col. 7, ll. 5-7.)

PRINCIPLES OF LAW

All timely filed evidence and properly presented arguments are considered by the Board in resolving an obviousness issue on appeal. *See In re Piasecki*, 745 F.2d 1468, 1472 (Fed. Cir. 1984).

In the examination of a patent application, the Examiner bears the initial burden of showing a prima facie case of unpatentability. *Id.* at 1472. When that burden is met, the burden then shifts to the Applicant to rebut. *Id.*; *see also In re Harris*, 409 F.3d 1339, 1343-44 (Fed. Cir. 2005) (finding

rebuttal evidence unpersuasive). If the Applicant produces rebuttal evidence of adequate weight, the prima facie case of unpatentability is dissipated. *In re Piasecki*, 745 F.2d at 1472. Thereafter, patentability is determined in view of the entire record. *Id.* However, on appeal to the Board it is the Appellant's burden to establish that the Examiner did not sustain the necessary burden and to show that the Examiner erred. *See In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection [for obviousness] by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.") (quoting *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998)).

"Section 103 forbids issuance of a patent when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.'" *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007).

In *KSR*, the Supreme Court reaffirmed that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *Id.* at 1739. The Court explained:

> When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar

> devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

Id. at 1740. The Court also explained that:

> [o]ften, it will be necessary . . . to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.

Id. at 1740-41.

"[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d at 988. "To facilitate review, this analysis should be made explicit." *KSR*, 127 S. Ct. at 1741. However, "the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *Id.*

The Supreme Court noted that "[u]nder the correct analysis, any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed." *Id.* at 1742. The Court also noted that "[c]ommon sense teaches . . . that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.*

"A person of ordinary skill is also a person of ordinary creativity, not an automaton." *Id.*

During examination of a patent application, a claim is given its broadest reasonable construction consistent with the specification. *In re Prater*, 415 F.2d 1393, 1404-05 (CCPA 1969). "[T]he words of a claim 'are generally given their ordinary and customary meaning.'" *Phillips v. AWH Corp.,* 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (internal citations omitted). The "ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application." *Id.* at 1313.

ANALYSIS

Appellant contends that the Examiner erred in rejecting claims 1-14 and 16-44. Reviewing the record before us and the findings of facts cited above, we do not agree. We conclude that the Appellant has not shown that the Examiner failed to make a prima facie showing of obviousness with respect to claims 1-14 and 16-44 and that Appellant failed to meet the burden of overcoming that prima facie showing.

Regarding claim 1, Appellant argues that Nayar and Glatt fail to teach or suggest "using a look-up table based on the configuration parameters" to map each pixel in the perspective window with a corresponding pixel value in the omnidirectional image on the image plane, as claimed. (App. Br. 8-10; Reply Br. 2-4.) In particular, Appellant contends that "Glatt does not teach or suggest how mapping could or would be performed using a look-up table for an image that comes, not from a fish-eye lens, but from a

reflective mirror as claimed" (Reply Br. 2) and therefore "one of skill in the art *cannot* take the teachings of Nayar and Glatt and, from them, practice the method of claim 1" (Reply Br. 4). We do not agree.

As the Examiner correctly found, Nayar teaches generating a selectable perspective view of a portion of a hemispherical image scene using a reflective mirror and an image sensor. (Ans. 3-4; FF 1-2.) The system of Nayar acquires an omnidirectional image on an image plane using a reflective mirror that satisfies a single viewpoint constraint, defines a perspective viewing window based on configuration parameters, and maps each pixel in the perspective viewing window with a corresponding pixel value in the omnidirectional image on the image plane. (Ans. 3-4; FF 1-6.) Although Nayar teaches that a "general purpose computer 125 can be readily programmed by one skilled in the art to perform the above steps to enable viewing of any portion of the hemispherical scene from a single viewpoint, and to also enable zooming in on any particular portion to provide an enlarged image of that portion" (col. 10, ll. 57-62; FF 2) and provides a mapping program (FF 5), Nayar does not explicitly show the use of a look-up table to perform the mapping. Glatt, however, teaches the use of a look-up table for mapping pixels in an image processing device. (Ans. 4; FF 7.)

We agree with the Examiner that it would have been obvious to one of ordinary skill in the art at the time of the invention to have used a look-up table, as taught by Glatt, in the method taught by Nayar. (Ans. 4, 20-22.) This is no more than the combination of familiar elements according to known methods, with no unpredictable results. *See KSR*, 127 S. Ct. at 1739.

Accordingly, we conclude that Appellant has not shown that the Examiner erred in rejecting claim 1 under 35 U.S.C. § 103(a).

With respect to independent claim 14, Appellant argues that Nayar and Gabriel do not teach or suggest "a memory storing a mapping matrix *for each of a plurality of sets of said configuration parameters*," (Reply Br. 7 (emphasis in original) as claimed. (App. Br. 11-13; Reply Br. 6-8.) We do not agree.

We agree with the Examiner that, by teaching a general purpose computer 125, Nayar suggests a memory. (Ans. 9; FF 2, 6.) We observe that the claim language "for storing a mapping matrix for each of a plurality of sets of said configuration parameters in a parameter space" merely describes the content of the data stored in the memory. Because this content does not further limit the claimed invention either functionally or structurally, it essentially constitutes nonfunctional descriptive material. Nonfunctional descriptive material cannot render nonobvious an invention that would have otherwise been obvious. *In re Ngai*, 367 F.3d 1336, 1339 (Fed. Cir. 2004); *cf. In re Gulack*, 703 F.2d 1381, 1385 (Fed. Cir. 1983) (when descriptive material is not functionally related to the substrate, the descriptive material will not distinguish the invention from the prior art in terms of patentability).

Moreover, even if the limitation "for storing a mapping matrix for each of a plurality of sets of said configuration parameters in a parameter space" were to be given patentable weight, we agree with the Examiner that the combination of Nayar and Gabriel teaches or suggests this limitation. (Ans. 9, 22-23; FF 1-4, 8.) We find the Examiner's interpretation of the broad term "configuration parameters" as taught by Gabriel (Ans. 9, 22-23) to be reasonable and not inconsistent with the Specification. In addition, we note that the plain language of the claim does not require that a mapping

matrix actually be stored in the memory, but merely requires that the memory be capable of storing a mapping matrix. We see no reason why the memory of the general purpose computer 125 of Nayar would not be capable of storing a mapping matrix. Although the controller is recited as using "a said mapping matrix to perform mapping of pixels," under the broadest reasonable interpretation of the claim the mapping matrix used by the controller need not be stored in the memory.

Accordingly, we conclude that Appellant has not shown that the Examiner erred in rejecting claim 14 under 35 U.S.C. § 103(a).

Independent claim 31 was argued on the same basis as independent claim 14 (App. Br. 12), and we sustain the rejection of claim 31 for the reasons discussed with respect to claim 14.

With respect to claim 38, Appellant argues that the combination of Nayar, Gabriel, and Korein does not teach or suggest a memory containing "a predetermined mapping matrix for every set of configuration parameters in said parameter space," as claimed and that the Examiner's interpretation of the claim is unreasonable. (App. Br. 13, Reply Br. 8-9.) We do not agree.

Again, we observe that the claim language "a predetermined mapping matrix for every set of configuration parameters in said parameter space" merely describes the content of the data stored in the memory. Because this content does not further limit the claimed invention either functionally or structurally, is essentially constitutes nonfunctional descriptive material. Nonfunctional descriptive material cannot render nonobvious an invention that would have otherwise been obvious. *In re Ngai*, 367 F.3d 1336, 1339 (Fed. Cir. 2004); *cf. In re Gulack*, 703 F.2d 1381, 1385 (Fed. Cir. 1983) (when descriptive material is not functionally related to the substrate, the

descriptive material will not distinguish the invention from the prior art in terms of patentability).

Moreover, even if the limitation "a predetermined mapping matrix for every set of configuration parameters in said parameter space" were to be given patentable weight, we agree with the Examiner that the combination of Nayar and Gabriel teaches or suggests this limitation. (Ans. 14-16, 23-24; FF 1-4, 8.) We find the Examiner's interpretation of the broad term "set of configuration parameters" as taught by Gabriel (Ans. 22-23) to be reasonable and not inconsistent with the Specification. In addition, once a particular set of configuration parameters were to be stored in a matrix, it would be trivial for a person of ordinary skill in the art to store additional sets of parameters -- including storing each and every set of parameters available in the parameter space.

Accordingly, we conclude that Appellant has not shown that the Examiner erred in rejecting claim 38 under 35 U.S.C. § 103(a).

No separate arguments in accordance with our rules have been presented for the rejection of claims 2-6, 16-23, 30, 32-37, and 44 as being obvious over Nayar in view of various combinations of Glatt, Gabriel, and/or Korein. Regarding claims 2-5, 18-20, and 34-36, Appellant merely states that certain limitations of these dependent claims are not taught or suggested by the applied references and summarily alleges error in the Examiner's findings. (App. Br. 10-11; Reply Br. 5-6.) But Appellant does not explain or show with any specificity why the Examiner's findings and explanations as to where the claim limitations may be found in the applied references (Ans. 4-5, 10, 16-17, and 22) are wrong. (*Id.*) Also, Appellant has not presented any arguments with respect to the rejection of claims 7-13,

24-29, and 39-43 as being obvious over Nayar in view of various combinations of Glatt, Gabriel, Chahl, Mick, Baker, and/or Korein.

Therefore, we will sustain the rejection of claims 2-13, 16-30, 32-37, and 39-44 for the reasons discussed with respect to independent claims 1, 14, and 31, from which they depend.

CONCLUSION OF LAW

Based on the findings of facts and analysis above, we conclude that Appellant has not shown that the Examiner erred in rejecting claims 1-14 and 16-44 for obviousness under 35 U.S.C. § 103.

DECISION

The rejection of claims 1-14 and 16-44 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

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